QUALITY ASSURANCE PROJECT PLAN

341 EAST OHIO STREET SITE

REVISION 2

JANUARY 11, 2002

PREPARED BY

STS CONSULTANTS, INC.

FOR

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

QUALITY ASSURANCE PROJECT PLAN

341 EAST OHIO STREET SITE

NOVEMBER 27, 2001

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341 EAST OHIO STREET SITE

QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT 2

Title: Quality Assurance Project Plan

Revision Number: 2

Date: January 11, 2002 Replaces: Revision Number 1

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LIST OF ACRONYMS

CFR	Code of Federal Regulations
DQO	Data Quality Objective
EPA	Environmental Protection Agency
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PE	Performance Evaluation
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
SOP	Standard Operating Procedure
UAO	Unilateral Administrative Order

PROJECT/TASK ORGANIZATION

ELEMENT A4

The management structure under which the project will be accomplished is illustrated in Figure 1 of this Quality Assurance Project Plan (QAPP). The Project Team consists of U.S. Environmental Protection Agency (USEPA) and it's support organizations; Teachers' Retirement System of the State of Illinois (TRS) and its consultants; the construction team comprised of STS Consultants, Ltd. (STS), their contractors and subcontractors; and Kerr-McGee Chemical, LLC and their contractors involved in the transportation and disposal tasks.

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) activities associated with the excavation and verification sampling at the GMO Site. All QA procedures will be in accordance with applicable professional technical standards, USEPA requirements, government regulation and guidelines, and specific project goals and requirements. This QAPP is prepared by STS Consultants, Ltd. (STS) in accordance with USEPA QAPP guidance documents, in particular, the Region 5 Instruction on the Preparation of a Superfund Division Quality Assurance Project Plan, Revision 0 and on the EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5).

The duties and responsibilities of these positions and organizations are summarized below.

A. Management Responsibilities

STS will supply the Project Coordinator who will provide overall direction to project activities and has overall responsibility for ensuring that the project meets USEPA objectives and quality standards. These responsibilities include communications between the project team and USEPA, and among the various members of the project team, including Kerr-McGee, the Health Physics subcontractor, the excavation contractors, and other subcontractors on the project. The Project Coordinator is the administrative point of contact between TRS and the USEPA. The position descriptions are included in Appendix A of the QAPP.

The TRS Project Manager, who will be responsible for communication between TRS and the project team, will represent TRS. The TRS Project Manager will review project documents, plans, and progress reports to confirm the plans and implementation are consistent with TRS objectives.

The STS Project Manager will be responsible for the day-to-day implementation of the Work Plan and this QAPP Plan. The Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. This will include coordination of schedules with the contractors and subcontractors, planning and scheduling activities with the USEPA to provide for verification of remediated locations, and documentation of activities as provided for in this Remediation Work Plan. The STS Project Manager may not be on-site daily, but will make inspection visits to the Site.

USEPA will be represented by its On-Scene Coordinators (OSC), whom will be Mr. Fred Micke and Ms. Verneta Simon. The OSC is responsible for directing and/or overseeing and coordinating all project activities. He or she is responsible for submitting QAPP and QAPP revisions and amendments to appropriate personnel for review and approval. Mr. Larry Jensen, Regional Radiation Expert and other support staff will assist the OSCs.

Kerr-McGee will be responsible for transportation and disposal of the radiologically impacted materials excavated and removed from the site. That responsibility includes health physics personnel to survey the transport containers, subcontractor transportation and logistics personnel, and documentation for shipping and disposal. The disposal is proposed to be under an existing contract with Envirocare of Utah, Inc. In the event Kerr-McGee is unable to fulfill this role, a logistics subcontractor will be available to complete this work.

B. QA Responsibilities

The Project Quality Assurance Supervisor will provide guidance on QA issues. The Project QA Supervisor is responsible for developing programs and tools to implement and monitor the QAPP plan. Specific functions and duties of the Project QA Supervisor include: provide QA audits on various phases of the field operations; review and approve of QA plans and procedures; provide QA technical assistance to project staff; and report on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager. The USEPA Region 5 Superfund QA Reviewer has the responsibility to review and approve QAPPs.

The Project QA Supervisor will provide the Project Coordinator copies of reports pertaining to quality assurance/quality control (QA/QC). The Project QA Supervisor functions independently from the personnel directly responsible for accomplishing the excavation and removal. He/she reports to the Project Coordinator and the TRS Project Manager and has access to higher levels of management with whom he/she can consult to resolve quality related project issues. The Project QA Supervisor will be responsible for internal and external performance and system audits. The Project Supervisor will be responsible for data assessment and validation.

C. Field Responsibilities

The Field Team Leader is responsible for coordinating the field activities, in particular coordinating the excavation and health physics technician subcontractors. The Field Team Leader will be responsible for day-to-day communications with the USEPA's OSC whenever the OSCs are on site. The Field Team Leader will be responsible for identifying and documenting non-conformance.

D. Laboratory Responsibilities

Argonne National Laboratory will provide laboratory subcontract services to USEPA for radiological analysis of samples from this project. A field laboratory will be used to analyze samples onsite. The Health Physics subcontractor, Stan A. Huber Consultants, Inc., will manage this laboratory. Off-site laboratory services will be provided by Severn Trent Laboratories (STL) of St. Louis; Missouri, RSSI of Morton Grove, Illinois; and Grace Laboratories of Chicago, Illinois. STL will perform waste characterization analyses, RSSI will serve in a back up capacity to STL, and Grace Labs will perform the potential groundwater analysis.

STL will perform the following analyses:

- Gamma spectroscopy
- TCLP Extraction
- TCLP Extraction – ZHE
- Volatiles
- Semi-Volatiles
- Pesticides (Organochlorine)
- Herbicides (Organochlorine)
- RCRA Metals
- Corrosivity (pH)
- Paint Filter
- Reactive Sulfide
- Reactive Cyanide
- Ignitability (Flashpoint)

Grace Labs will perform the following groundwater analyses if determined necessary:

Waste or Chemical	Concentration (mg/L)
Cadmium	0.11
Chromium (total)	2.77
Copper	2.07
Cyanide (total)	1.20
Fats, Oils and Greases (FOG) (total)	250.0
Iron	250.0
Lead	0.5
Mercury	0.0005
Nickel	3.98
Zinc	2.61
Dichloromethane	0.294
Chloroform	0.309
1,1,1-Trichloroethane	0.193
Trichloroethylene	0.242
Benzene	0.278
Tetrachloroethene	0.225
Toluene	0.247
Ethylbenzene	0.329
Volatile Organic Compounds (total)*	0.567
Total Toxic Organics**	2.13

pH Range - Not lower than 5.0 or greater than 10.0

Temperatures of liquids or vapors at point of entrance to the sewerage system shall not exceed 150°F.

* Total Volatile Organic Compounds shall be the arithmetic sum of the concentrations of:

Dichloromethane
Chloroform
1,1,1-trichloroethane
Trichloroethylene
Benzene
Tetrachloroethene
Toluene
Ethylbenzene
Acrolein
Acrylonitrile
1,3-butadiene
carbon tetrachloride
Chlorobenzene
Dichloroethane
Dichlorobenzene
1-ethyl 2-methylbenzene
Naphthalene
Styrene
1,3,5-trimethylbenzene
vinyl chloride
Xylenes
1,4-dioxane

ethylene dibromide
methyl ethyl ketone

** Total Toxic Organics shall be the arithmetic sum of the concentrations of those pollutants found under Title 40 Part 413.02(i) of the Code of Federal Regulations.

E. Special Training Requirements/Certification

All of the designated technical team members possess the degree of specialization and technical competence to effectively and efficiently perform the required work. All team members visiting the site will be trained and certified in accordance with 29 CFR 1910.120, as described in the Health and Safety Plan (Attachment 3 of the Remediation Work Plan).

F. Project Management Organization Chart

The Project Management Organization Chart shows the relationships and the lines of communication among all project participants, including the USEPA. The organization chart identifies subcontractor relationships relevant to environmental data operations.

PROBLEM DEFINITION/BACKGROUND INFORMATION
ELEMENT A5

The subject site for this Work Plan and QAPP is a vacant parcel of approximately 2.16 acres located at 341 E. Ohio Street, Chicago, Illinois and is depicted on Figure 1-1 of the Removal Action Work Plan. The site is currently a vacant, at-grade paved parking lot; however, the site is not presently being used for parking. TRS previously made a mortgage loan secured by the site and after such mortgage went into default, TRS subsequently acquired the site by deeds in lieu of foreclosure.

The site is across the street (north of East Grand Avenue) from the site at 316 East Illinois Street in Chicago, Illinois which is owned by River East, LLC, and on which radiological impacted soils were previously detected by the USEPA. USEPA determined that the radiologically impacted soil at the 316 East Illinois Street site was associated with the former operations of Lindsay Light Company at 161 East Grand Avenue. On June 6, 1996, USEPA issued a Unilateral Administrative Order ("UAO") pursuant to Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") to the Chicago Dock and Canal Trust (now known as River East LLC) and to Kerr-McGee Chemical Company (the corporate successor of Lindsay Light Company and now known as Kerr-McGee Chemical, LLC) requiring River East and Kerr-McGee to perform a removal action with respect to the radiologically impacted soil on the 316 East Illinois Street site (which USEPA designated "Lindsay Light II") and on any areas off the Lindsay Light II site on which such radiologically impacted soils were found. Subsequently, radiological impacts were discovered at the site which was owned by Grand Pier Center, LLC immediately to the west of (and across Columbus Drive) Lindsay Light II and which was designated by USEPA as "Lindsay Light II/RV3 North Columbus Drive". USEPA determined that the radiological impacts at Lindsay Light II/RV3 North Columbus Drive were associated with the former operations of Lindsay Light Company. On March 29, 2000, USEPA amended the UAO to require Kerr-McGee, River East and Grand Pier to perform removal action at Lindsay LightII/RV3 North Columbus Drive.

TRS has previously entered into a contract to sell the subject site to a third party purchaser that engaged environmental consultants to perform environmental investigations of the site. B. Koh & Associates, Inc. ("Koh") performed a radiological investigation of the site including surface gamma radiation readings, down-hole radiation readings and soil sampling and analysis. Koh's report dated May 2000 documented its findings of elevated gamma radiation and radiological concentrations at the site. TRS reported the findings in the Koh report to USEPA. On March 1, 2001, USEPA issued an Action Memorandum Amendment setting forth determinations by USEPA that, among other things, (1) the radiological impacts at the site are associated with the former operations of Lindsay Light Company and (2) the UAO requires Kerr-McGee to proceed with a removal action with respect to the radiological impacts at the site.

TRS has made demand on Kerr-McGee to perform all removal actions required at the site but Kerr-McGee has not agreed to perform all such removal actions. In order to provide for the performance of the removal actions, TRS and Kerr-McGee have agreed that (1) TRS will perform excavation, screening and sampling at the site as described in this Removal Action Work Plan, (2) Kerr-McGee will transport and dispose of the radiologically impacted soils removed from the site, and (3) TRS and Kerr-McGee reserve their rights to, among other things, recover their costs with respect to their respective work activities which they will perform with respect to the site.

The following reports of previous environmental investigations were provided by TRS for the preparation of this Removal Action Work Plan.

- Letter dated August 22, 1990 from OHM Corporation to GMO Limited Partnership
- Environmental Site Assessment dated August 28, 1990 prepared by Professional Service Industries, Inc.
- Visual Site Inspection dated December 30, 1993 prepared by USEPA, Region 5, with attached Preliminary Assessment/Visual Site Inspection Report dated December 16, 1993 prepared by PRC Environmental Management, Inc.
- Preliminary Environmental Review dated March 8, 2000, prepared by GaiaTech, Inc.
- A Phase II Soil and Groundwater Investigation Report Time-Life Property, Grand Avenue and McClurg Court, Chicago, Illinois, dated May 11, 2000, prepared by GaiaTech, Inc.

- Summary of Radiological Survey Time-Life Property, Chicago, Illinois, dated May 2000, prepared by B. Koh & Associates, Inc.
- Scanner Van Survey of the Chicago, Illinois Streeterville area dated July 12, 2000 prepared by USEPA Radiation and Indoor Environments National Laboratory.

The intent of the removal actions is to perform the site survey, identify impacted soil and materials, and remove all impacted soil and materials to the proposed cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228). The following activities must be accomplished to complete the project:

- All identified radiologically impacted material above the proposed cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228) has been removed from the site
- TRS has received USEPA verification sign-off that all radiologically impacted materials above the cleanup threshold have been removed from the site
- Equipment and personnel have been demobilized from the site
- TRS has submitted the required documentation to USEPA for closure of the site
- USEPA has responded acknowledging the sufficiency of the removal and documentation, in accordance with the UAO and Amendments

PROJECT/TASK DESCRIPTION AND SCHEDULE

ELEMENT A6

A Project Tasks

There are three phases of removal work: the Investigation and Delineation Phase; the Initial Contaminant Removal Phase; and the Site-wide Excavation, Monitoring, and Removal Phase. The Investigation and Delineation Phase was begun with the survey and sampling work previously completed by Koh as reported in their May 2000 report. This phase will continue with the site surveys to be conducted as the asphalt pavement is removed. The Initial Contaminant Removal Phase will consist of the removal of the radiologically impacted zones identified in Phase 1. Finally, the Site-wide Excavation, Monitoring and Removal Phase will involve the surveying of all fill soils on-site, and the segregation and removal for disposal of all radiologically impacted soils encountered. A more complete description of these activities is presented in Section 3.0 - Methodology of the Remediation Work Plan.

Task 1 - Investigation/Delineation Phase, Project Quality Objective.

On May 31, 2000, TRS informed USEPA that elevated levels of radioactive materials had been detected at the GMO property. This notification was based on the Koh report dated May 2000, which documented the presence of seven locations on site that exhibited gamma radiation levels above background levels, and the results of radiologic analysis showing radioactivity levels requiring removal. This information was supported by the USEPA Scanner Van radiation survey of the GMO property and a gamma survey meter walkover by USEPA staff. Following this disclosure, TRS, Kerr-McGee LLC, and USEPA met several times to discuss the extent of the contamination on the GMO property and make preparations for its cleanup. Also, a letter was sent to TRS and Kerr-McGee on July 13, 2000. This letter addressed the need to prepare a Remediation Work Plan for a site cleanup in accordance with the June 6, 1996 UAO.

The project quality objectives for the proposed work plan are threefold. The removal is intended to result in all soil above the clean-up criteria of 7.1 pCi/g total radium being removed from the site. Field and laboratory data quality and minimum detection limits must be sufficient to confirm that all soils exceeding this threshold have been removed. Achieving this objective will result in unrestricted use of the property with regard to radiologic impacts.

The second objective is to confirm that all radiologically impacted soils are disposed at facilities licensed to accept these materials. The Work Plan covers the removal of the radiologically impacted soils for disposal at Envirocare of Utah, Clive, Utah. Other materials, which may be removed from the site, include the asphalt pavement, large demolition rubble such as foundation walls or floor slabs, and possible chemically contaminated materials unsuitable for use as backfill. The screening criteria (7.1 pCi/g) and data quality objectives (disposal at a facility permitted for the material) for the non-radiological material excavated from the site, i.e., pavement and chemically impacted material, will be the same as for the uncontaminated soil which remains on site. The larger blocks of demolition debris will be cleared by frisking and wipes in accordance with requirements per 32 IAC Part 340 Appendix A for off-site release of equipment.

The third objective is to confirm that all personnel working on the site are working under conditions that reduce or eliminate potential exposure to contamination. The air monitoring, film badge monitoring, and PPE requirements specified in the Health and Safety Plan, Attachment 3 to the Work Plan provide for those objectives to be met.

As the project progresses and areas are remediated, the documentation of clean closure will be generated by USEPA. The remedial objective of removing all radiologically impacted soil will be met when the project site has been documented as having met the clean-up criteria over the entire parcel and USEPA acknowledges the removal action is complete.

Task 2 - Target Compounds

The Lindsay Light Company produced incandescent gas mantles near the GMO site. Some manufacturing and/or processing of thorium-bearing monazite sand reportedly took place at the 316 East

Illinois Street site. A principal ingredient in gas mantle manufacture is thorium as a nitrate. Small amounts of cerium, beryllium, and magnesium nitrates are also used. Thorium was extracted from the monazite sand using an acid leach. The gas mantles were then dipped into a solution containing the thorium nitrate to provide the mantle's incandescence strength.

Thorium occurs in nature principally as the parent radionuclide Thorium-232 in association with its daughter products in a decay sequence known as the Thorium Decay Series. It is believed that the principal source of contamination at this site is Thorium 232 and thorium decay series nuclides. Cleanup levels will be based on total radium, Ra-226 and Ra-228. The clean-up level specified by USEPA is 5 pCi/g total radium above the background level. Background levels have been determined on vicinity properties to be 2.1 pCi/g total radium. This results in a clean-up criteria of 7.1 pCi/g total radium.

Radiologic analysis of soils from the subject site were performed in May 2000. The results of those analyses indicated the presence of thorium and thorium decay chain compounds only. This would include Ra-228, but not Ra-226. Results as high as 2880 pCi/g of thorium 288 were measured. Analysis for the surrogate Ac-228 on the same sample measured 2110 pCi/g.

Task 3 - Sampling Rationale

The radioactive materials are present in the soil and urban fill. No evidence of groundwater contamination has been identified. Any water removal from the site will be allowed to settle any suspended sediment before discharge. Fugitive dust will be monitored. The principal matrix of concern is soil contamination. The following will be completed prior to any site work:

- The site grid at 5 meter spacing will be established.
- The site boundaries will be located and marked.
- The location of all surface features such as the guardrail, storm drain catch basins, utility vaults, light standards, etc. will be mapped.
- A photographic record of the site will be made and retained in the project files.

The beginning of the removal work task will be to begin removal of the asphalt pavement cover in stages. Once the asphalt paving is removed from each area of the site, 100% of the soil surface in each such area will be surveyed for elevated gamma readings. The survey will cover the exposed soil on survey lines spaced 5 meters. Gamma count values shall be taken at intervals spaced 5 meters (5 x 5 meter grid). The site grid will be marked by stakes and flagging at the edges of the property and by paint on the ground surface on the interior of the site. The areas between the grid points will be scanned following the Gamma Radiation Survey Procedure SOP 210 so as to cover the intra-grid areas. Each exclusion zone will be verified as meeting the clean-up criteria in accordance with the Verification Sampling Procedure, SOP-223.

The sample network design and rationale for sample locations are described in detail in the Field Sampling Plan (FSP) (Appendix 9 of the Remediation Work Plan).

Task 4 - Analytical Rationale

Sample matrices, analytical parameters, and frequencies of sample collection are shown in Table 1-1. The waste characterization analyses are for the purpose of documenting whether the material proposed for disposal at Envirocare of Utah is a RCRA hazardous waste. That demonstration will involve testing for parameters to evaluate the material for characteristic hazardous waste. SOPs for the waste characterization and groundwater analyses to be performed can be found in Appendix B.

Should it be necessary to discharge water into the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) combined storm and sanitary sewer system, analysis will meet the MWRDGC Appendix A discharge parameters list.

Other analyses are for the radiological constituents of concern. Constituents of concern for the removal documentation analysis have been selected based on constituents that represent the known contaminants. The constituents of concern are the entire thorium and uranium decay series; however, measurements will only be made for Ra-226 and Ra-228.

Soil samples will be analyzed for Ra-226 and Ra-228. Sample splits will be performed in the laboratory. Verification analyses will be performed on sub-sets of six samples. It is not proposed to analyze split samples due to the potential for heterogeneous materials

TABLE 1: SUMMARY TABLE OF SAMPLING AND ANALYSIS PROGRAM

Matrix	Lab/# of Samples			
	Severn Trent	RSSI	Field Lab S.A. Huber	Argonne National Lab
Soil Waste Characterization[1] Field Blank Trip Blank Lab Dup	 10 1 1 2			
Soil (Removal Action)[2] Estimate 5/day x 16 weeks x 5 day/week		Back-up capacity	Minimum 1 per exclusion zone, plus excavation monitoring- estimate 400	As requested
Groundwater (MWRDGC Discharge Permit Application) [3] Lab Dup Trip Blank	 1 1 1			
Soil (Closure Verification) [2] approx. 8,900 m^2. 6 samples per 100 m^2		Back-up capacity	6 per 100 m^2; est. 534	6 per 100 m^2; est. 534
Air (perimeter monitoring, personal air monitoring)[4] Daily Perimeter (4/day, 16 weeks x 5 days) Daily PAM (estimate 2/day x 16 weeks x 5 day)		Back-up capacity	Perimeter, 4 daily = 320 PAM, est. 2 daily = 160	
Soil (Lab cross validation) same set of 10 samples rotated to each laboratory		1 set, 10 samples	1 set, 10 samples	1 set, 10 samples

[1] Waste Characterization: TCLP volatiles, TCLP semi-volatiles, TCLP metals, herbicides, pesticides, gamma spec.
[2] Removal Action, Closure Verification: Radium-226, measured directly or using lead 214 as a surrogate. Radium-228, using actinum 228 as a surrogate. Nutranl system analysis by S.A. Huber or RSSI. High Resolution germanium detector by Argonne.
[3] MWRDGC Discharge Permit application: Appendix A pretreatment standards including gross alpha and gross beta.
[4] Site perimeter Air Monitoring, Personal Air Monitoring: alpha radiation emitters.

producing disparate results. Rather, the same samples will be run in each laboratory to provide for comparison of results on the same soil material.

The on-site laboratory Standard Operating Procedures (SOPs) for radiological analysis of samples will be used for this project. These project-required SOPs are included in Appendix B. TRS will provide the samples on a routine basis at the request of the USEPA. Air samples will be analyzed for gross alpha. Air samples will not be split. The procedures for radiological surveys are described in the FSP.

Air monitoring activities will also be a part of this QAPP. Airborne radioactivity data will be collected to evaluate the effectiveness of work procedures and site control measures. In addition to identifying the need for procedure modification, air monitoring also documents the effectiveness of such modifications. The collected airborne radioactivity data will measure releases of airborne radioactivity to the environment and ensure that people living and working in the area are not exposed to radiation above regulatory limits. The air monitoring program is described in more detail in the FSP.

Task 5 - Data Validation

Data will be validated at each step of collection, reduction, and reporting. This will include validation of the following:

- Laboratory validation of data will follow standard operating procedures. Laboratory validation of data will consist of monitoring the variations in the accuracy and precision of routine analytical procedures through the use of recovery values and blanks.
- Field data validation will follow standardized data collection procedures, including calibration procedures will be used. Each person assigned to each data collection task is responsible for understanding and employing the standard procedures to be used. Field data collected will be recorded on appropriate data collection forms or a field notebook.
- Laboratory data received from the analytical and soil laboratories will be reviewed by the project manager for obvious discrepancies. The data validation process will include an assessment of holding-time compliance, laboratory instrument tuning and performance, calibration procedures, results of calibration, and results of equipment, travel, and method blanks.
- Calculations include data manipulations made that can be checked and that are made in conjunction with the analysis or interpretation of data, engineering design, cost estimate, or any other related activity. Calculations will be reviewed according to the applicable procedures in this document.
- Upon receipt of data reports from the laboratories, data will be reviewed for obvious discrepancies. After screening, the data will be entered into the appropriate database.

After data entry, the entries will be printed and checked against the original data. Errors will be corrected and the corrections verified by checking against the original data.

Further details on data validations tasks and procedures are included in Element D1 of this QAPP.

Task 6 - Quality Assurance Assessments

Quality Assurance Assessments will be conducted of the field survey data through sampling and laboratory analysis of soils. Sampling will include both soil with high field readings indicating radiologic impacts well above the clean-up criteria, and soil with low field readings indicating material below the clean-up criteria. Samples will be taken of the highest material encountered in each inclusion zone on a daily basis. Samples will also be taken on a daily basis of soil indicating level below the clean-up criteria. These analyses will be run at the field laboratory.

Quality assurance assessment of the field laboratory will be done periodically through the analysis at a second laboratory of the soil samples analyzed at the field laboratory. Those analyses will be run at either the USEPA subcontract laboratory, Argonne National Laboratory, or at one of the subcontract laboratories for STS, which include Severn Trent of St. Louis, Missouri, or RSSI of Morton Grove, Illinois.

Internal and external performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and the QAPP. Internal audits of field activities (sampling and measurements) will be conducted by the TRS Project Quality Assurance Supervisor. The audits will include, but not be limited to, examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. External audits may be conducted by personnel from the USEPA Region 5 Air and Radiation Division with assistance from USEPA's National Air and Radiation Environmental Laboratory and/or USEPA's Environmental Monitoring Systems Laboratory.

The internal performance and system audits of the laboratories will be conducted by a qualified STS auditor. The system audits, which will be done annually, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedure, sample preparation and analysis, instrument operating records, etc. External performance and system audits of the laboratories may also be conducted by USEPA Region 5 Air and Radiation Division personnel.

Further details on the planned QA assessments are contained in Element C1 of this QAPP.

Task 7 - Data Usability Assessment

Data, which has been validated in accordance with the procedures in Task 5 above, will be reviewed and reconciled with the Project Data Quality Objectives. Specifically, this review will assess the ability to document that the clean-up criteria are being met for material remaining on site, the measurements and documentation are adequate for the material being shipped off site, and health and safety measurements are within data quality limits for all personnel potentially exposed to radiologically impacted materials. Further details on the data usability assessment are contained in Element D3 for this QAPP.

Field data will be assessed by the STS Project Manager or her designee. She will review the field results for compliance with the established QC criteria that are specified in the QAPP and FSP. Laboratory results will be assessed for compliance with required accuracy and completeness as follows:

- Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in Element C1 of this QAPP.
- Data completeness of laboratory analysis results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using the following equation:

  $$\text{Completeness (\%)} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

- Data will be validated at each step of collection, reduction, and reporting.

The proposed QA system employs corrective and preventive action to correct and eliminate root causes of problems which are systemic and/or repetitive, or which could occur at a future time. Corrective action is necessary to remedy nonconformities that occur in the QA System. Corrective action includes:

- Identification of observed nonconformances in supplied product, services, operations, or output product
- Investigation of the discrepancy
- Determination of the cause
- Initiation of actions to correct the nonconformance to a degree appropriate to the magnitude of problems and commensurate with the risks encountered
- Evaluation of the effectiveness of the corrective action in preventing recurrence
- Changing the system and system documentation when necessary

Task 8 - Project Documentation

Field notebooks, field reports, sample data logs, soils radioactivity data, sample data analyses, progress reports, audits reports, quality control reports, equipment maintenance reports, health physics data, civil construction and excavation data, material transport records, chain of custody records, verification sampling, and closure documents will be generated for the removal actions at the GMO site. Given the relatively short anticipated duration of the excavation activities for this project, data can be effectively managed utilizing the paper records required in the Removal Action Work Plan.

An on-site field laboratory will be used to analyze soil samples as excavation and removal proceeds, and for pre-verification sampling that the clean-up criteria have been met. Analytical records will be kept at the site and at the Vernon Hills, Illinois offices of TRS's contractor, STS Consultants, Ltd. Air monitoring analyses will be maintained at both the site and STS's offices, and will be transmitted with the weekly progress reports to USEPA.

B. Project Schedule

The Project Schedule (Figure 3-2) shows the projected start and completion dates for project activities. The project's completion within the constraints of this schedule is dependent upon the weather factors cited below, the timely approval of the Removal Action Work Plan by USEPA, and the timely receipt of any required permits.

Constraints on unloading frozen soils at Envirocare indicate that it will generally not be feasible to excavate in cold weather. The freezing of soils in the shipping containers and the general prospects for inclement weather would seriously affect soil-handling operations at the Site. As a result, the schedule proper completion of excavation and transport to Envirocare by late fall 2001.

QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA ELEMENT A7

The overall QA objective is to meet and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that accurately depict the quantities being measured. Specific procedures for sampling, chain-of-custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, corrective action, types of quality control checks required (reference samples, controls, blanks, interlaboratory comparison), the frequency of each check, and the quality control acceptance criteria for these checks are described in other sections of this QAPP. Radionuclide analyses of soils by gamma spectroscopy is not amenable to sample surrogate spikes. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability.

A. Data Quality Objectives (DQOs) Process

Step 1: Stating the problem

There are three phases of work that comprise this Work Plan. These consist of the Investigation and Delineation Phase, the Initial Contaminant Removal Phase, and the Site-wide Excavation, Monitoring and Removal Phase. The Investigation and Delineation Phase was begun with the survey and sampling work previously completed by Koh and Associates, as reported in their May 2000 report. This survey and sampling included walkover gamma scans on all accessible portions of the parking lot and soil samples obtained from 33 borehole locations. Thorium concentrations at 7 locations were found to exceed the NRC release limit (see Figure 1).

This phase will continue with the site surveys to be conducted as the asphalt pavement is removed. The Initial Contaminant Removal Phase will consist of the removal of the radiologically impacted zones identified in Phase 1. Finally, the Site-wide Excavation, Monitoring and Removal Phase will involve the surveying of all fill soils on site, and the segregation and removal for disposal of all radiologically impacted soils encountered.

Given the site's manufacturing history, some of the radiologically-impacted soils might also be contaminated with hazardous wastes. Radiologically-impacted soils will be sampled and waste characterization analyses performed to determine the appropriate disposal method.

Step 2. Identifying the Decision

The Decision Statement is: "Determine whether soils, in addition to those areas already identified as radiologically-impacted, need to be removed to clear the site of all radiologically impacted soils. Determine whether the known radiologically impacted soils in the previously identified contaminated zones also contain hazardous wastes."

Step 3: Identifying Inputs to the Decision

Inputs to the decision will include previous sampling efforts and previously established regulatory thresholds for adjacent properties. The Koh and Associates May 2000 Report presents survey and sampling results from the site. The survey and sampling included walkover gamma scans on all accessible portions of the parking lot and soil samples obtained from 33 borehole locations. Thorium concentrations at 7 locations were found to exceed the NRC release limit. Once the radiologically impacted soils have been removed from these known locations, all remaining fill soils on the site will be sampled in 18-inch lifts.

USEPA has previously established the baseline cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228) for other sites covered by the UAO. This is the proposed threshold level for this Site also.

<u>Step 4: Defining the Boundaries of the Study</u>

The boundaries for the Study are property line, up to but not including the sidewalks. The scale of decision making is the entire site, including the surface soils and subsurface fill down to native soils and/or sand. The temporal boundaries of the Study are sampling during temperate weather. Excessive rain and subfreezing temperatures will halt the sampling and cleanup activities. No additional constraints to data collection exist.

<u>Step 5: Developing a Decision Rule</u>

The decision rule is "if elevated gamma readings are detected (above 7.1pCi/g) total radium (Ra-226 + Ra-228) during the survey of 100% of the soil surface, that soil will be removed in 18-inch lifts until such time as no elevated readings are detected, and the underlying soil is verified as clear of radiological impacts by USEPA."

The decision rule for the waste characterization is "for those soils with radiological impact in excess of the threshold level, if any hazardous chemicals are detected in concentrations above the regulated allowable limit, they will be separated and disposed of separately from the soils with only radiological impacts."

<u>Step 6: Specifying Limits on Decision Error</u>

Given the level of readings encountered in the Koh study, the removal action will commence with the areas of known radiological impact. After removal of these known soils, all remaining soil will be sampled. Since all soil on the site will be sampled, and verification sampling will be performed on the entire site, the probability of a decision error occurring which results in radiologically-impacted soils being left on the site is less than one percent. Decision errors for the laboratory analyses are part of the laboratory's SOPs and Method Procedures.

Step 7: Optimizing the Design

The first phase of sampling on the site was completed in the Koh study, which resulted in mapped locations of known radiological impact. In addition to these known areas of impact, upon removal of the existing asphalt the entire site will be measured for radiological impact exceeding the threshold amount, using a 5 x 5 grid and complete sampling of the intergrid areas. Sampling of all soil and the verification sampling of the remaining underlying soil is viable, when considering the known levels of contaminants and the temporal constraints. Verification sampling will be performed for the entire site once all the fill soils have been sampled for radiological impact and separated for disposal of the radiologically impacted soils.

B. Measurement Performance Criteria

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols. Accuracy is a measure of the nearness of a measurement to the true value of the quantity being measured.

Precision is a measure of the closeness to each other of repeated measurements of the same quantity. Duplicate (laboratory split) samples are considered to represent the same population if analyzed values are within two standard deviations of the population mean. That is:

$$A \pm a\sigma - B \pm b\sigma = 0$$

for some value of "a" and "b" when "a" and "b" range from 0 to 2.

The sensitivities required for radionuclide analyses will be the U.S. Nuclear Regulatory Commission (USNRC) Regulatory Guide 4.14.

Precision is defined as an estimate of variability in a measured property, that is, an estimate of agreement among individual measurements of the same property under similar conditions (paraphrased from the subcontract laboratory QAMP, Section 8.3.1, page 45 or 92). Precision of a measurement is affected by random errors, or random variability in the measured property.

Inasmuch as radioactivity is a measurement of the decay of a population of radionuclides and the specificity of decay of an atom is random, it is only in a sufficiently large population that the precision is achieved. Higher levels of activity will result in increased precision, given a constant counting time. Increased precision will result from increased count times for low activity material.

The data quality objectives for the laboratory analyses through the subcontract laboratory are provided in tables 8.4-5, 8.4-6 and 8.4-7 in Section 8 of the laboratory QAMP, attached as Appendix D.

Table 2 presents the data quality objectives for the field measured data. Note that these apply to the contaminant and removal documentation measurements, principally radionuclides, and not to operational measurements such as dewatering wells, excavation side slopes or dust control.

Table 2. QA Objectives for Field Measurements

Matrix	Measured Parameter	Test Method	Precision [1]		Accuracy [2]	Completeness
			Low	High		
Soil	Gamma counts per minute	SOP 210	+- 30%	+- 10%	10% for analog and digital ratemeter, 2% for digital scaler	+95%
	Gamma survey mode (2 second rolling)	SOP 210	+- 50%	+- 20%	10% for analog and digital ratemeter, 2% for digital scaler	+ 95%
Soil	Th - 232	NUTRANL	+- 100%	+- 25%	~+ 20% [3]	95%
	Ra - 226	NUTRANL	+- 100%	+- 30%	~+ 20% [3]	95%

1 High activity is defined as 2x the cleanup criteria of 7.1 pCi/g.

2 Per Manufacturer specifications (Ludlum 2221 Scaler Ratemeter, October, 1998)

3 Over-estimate based on comparison with USEPA laboratory results, Argonne National Lab.

Accuracy is defined as the extent of agreement between sample results and the true value of the parameter being tested, in this case, the level of radiological contamination. Laboratory control samples will be used to evaluate sample accuracy, using spiked samples. The accuracy of the spiked sample is measured by the percent recovery of the analyte. The spike recovery is calculated as follows:

$$\text{\% Recovery Accuracy} = \frac{\text{Spiked Sample Conc.} - \text{Unspiked Sample Conc.} \times 100}{\text{Spiked Concentration Added}}$$

The SOPs for the field radionuclide screening are outlined in Document 210 of Appendix B. Accuracy and precision requirements for field screening analyses are included in Table 3. Sensitivity requirements of equipment are specified in the SOP describing the equipment. The laboratory's sensitivity for Ra-226 and Ra-228 is summarized on Table 5. Tables 6 and 7 show the minimum detectable limits for Total Solid Particulates (TSP) by Th-Alpha (gross alpha) and the minimum detectable activity for TSP by gamma spectroscopy and the minimum detectable levels for gross alpha and gamma spectroscopy, respectively.

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness (\%)} = \frac{\text{number of valid data}}{\text{number of samples collected for each parameter analyzed}} \times 100$$

Data generated by the laboratory has a completeness target of 90 percent.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. The rationale of the sampling network is discussed in detail in the FSP. Representativeness will be satisfied by assuring that the FSP is followed, proper sampling technique are used, proper analytical procedure are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of duplicate (laboratory split) samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

Table 3
Summary of Sample Collection and Analysis [(a)]

Purpose	Sample Method	Ra-226 and Ra-228 Analysis	Alpha	Duplicate (Field Split) Samples
Air Monitoring	High-Volume Air Monitoring Station	(b) (c)	(b)	0
Verification Sampling	Soil Sampling	(d)	-	6 sub-samples per set

(a) Does not include field QC samples.
(b) A minimum of one sample collected from four separate air monitoring locations per 8 hour period (one day of operation) for the site. Filters will be changed daily. TSP analysis procedures are described in Section 5.3 of the Air Monitoring SOP-212.
(c) Air samples will be tested for gross alpha.
(d) Verification sampling frequency defined in Verification Sampling Plan (Appendix 5 of the Remediation Work Plan).

Table 4

Radiological Laboratory QA Objectives

Purpose	Method	Accuracy	Precision	Completeness
Ra-226 and Ra-228	NaI Gamma Spectroscopy	±l- 2σ	±l- 2σ	90
Ra-226 and Ra-228	HpGe Gamma Spectroscopy	±l- 2σ	±l- 2σ	90

Table 5
Minimum Detectable Activity for the On-Site Laboratory Soil Counter
by Gamma Spectroscopy

Counting Time	Ra-226, pCi/g	Ra-228, pCi/g
2-Minutes	1.40 ± 0.60	1.30 ± 0.56
5-Minutes	0.93 ± 0.40	0.83 ± 0.36
10-Minutes	0.67 ± 0.29	0.62 ± 0.27
20-Minutes	0.61 ± 0.26	0.55 ± 0.24

The onsite laboratory conditions are:

- 20 gram soil placed in a 20-ml polyethylene liquid scintillation counting vial
- Sample counted in a Packard Minaxi system (NaI (Tl) well-type gamma detector)
- Date processed using NUTRANL software. The standard deviation includes the compounded errors of the analysis
- Minimum Detectable Activity per USNRC Regulatory Guide 4.14 (at 4.65 times the standard deviation of the analysis for the instrument background).

Table 6
Minimum Detectable Limits for Th-Alpha (Gross-Alpha)
By TSP (Total Solid Particulates)

Air Sample Type	Run Time (mins)	Flow Rate (L/min)	Volume (cc)	Alpha BKGD (counts/min)	Alpha MDA [(a)] (dpm)	Alpha MDA (μCi/cc)	Th-232 MDA [(b)] (μCi/cc)
Craseby GMW-2000	10080	1416	1.4E+10	0.3	0.5	4.7E-17	9.4E-18
SAIC AVS-80A	1440	169.9	2.4E+08	0.3	0.5	2.7E-15	5.4E-16
SAIC AVS-60A*	480	198.2	9.5E+07	0.3	0.5	7.0E-15	1.4E-15
Eberline RAS-1	480	45	2.2E+07	0.3	0.5	3.1E-14	6.2E-15

Air Sample Type	Run Time (mins)	Flow Rate (L/min)	Volume (cc)	Alpha BKGD (counts/min)	Alpha MDA (dpm)	Alpha MDA (μCi/cc)	Th-232 MDA[(b)] (μCi/cc)
MSA Flow-Lite	2400	2	4.8E+06	0.4	0.6	1.6E-13	3.2E-14

(a) MDA calculated per USNRC Regulatory Guideline 4.14 assuming samples counted on a gas flow proportional counter with an efficiency of 34.1 % and a count time of 30 minutes.

(b) The Th-232 decay series contains seven alpha-emitting nuclides: Th-232, Th-228, Ra-224, Rn-220, Po-216, Bi-212, and Po-212. Of these, the first three nuclides can be assumed to be in complete equilibrium. The noble gas Rn-220 (thoron) may be ejected from the original matrix by recoil from the alpha particle decay of Ra-224. The fraction of Rn-220 that is removed via emanation is dependent on several variables, and is assumed to range from 10 to 40%. The emanating fraction is assumed to be transported away from the original matrix. If 40% of the Rn-220 escapes, the activity of the Rn-220 and its three alpha-emitting progeny nuclides will be at 60% of the Th-232 activity. These four alpha-emitting nuclides produce a total of 3.35 alpha emissions per Rn-220 decay. Since the Rn-220 activity is 60% of the Th-232 activity, these four nuclides only emit the equivalent of two alpha particles per Th-232 decay. These two alphas when combined with the three alpha particles from the nuclides in full equilibrium with the parent, result in the total emission of the five alpha particles. Thus, the Th-232 contribution will be one-fifth or 20% of the total alpha activity.

Table 7
Minimum Detectable Activities for Gamma Spectroscopy

Nuclide	MDA, uCi	TSP Volume, ml	MDA, uCilml
Pb-210	4.0E-05	9.5E+07	4.2E-13
Pb-212	2.0E-06	9.5E+07	2.1 E-14
Pb-214	3.7E-06	9.5E+07	3.9E-14

Bi-212	3.0E-05	9.5E+07	3.2E-13
Bi-214	4.4E-06	9.5E+07	4.6E-14
Ac-228	1.1 E-05	9.5E+07	1.2E-13
Th-234	1.1 E-05	9.5E+07	1.2E-13
Pa-234m	8.6E-04	9.5E+07	9.1 E-12

SPECIAL TRAINING REQUIREMENTS/CERTIFICATION
ELEMENT A8

Radiation field surveys will be conducted by health physics technicians experienced and trained in the use of the instruments. Radiation survey work will be conducted under the supervision of a certified health physicist, and reviewed by the Project Coordinator and STS Project Manager.

The field laboratory will be operated by a health physics technician trained in the operation of the NUTRANL software and detector equipment. The alpha counter will also be operated by an experienced health physics technician. All NUTRANL and alpha counter data will be reviewed by the health physics supervisor.

Site and project specific radiation and health and safety training will be provided for all on-site personnel prior to work on-site. All personnel required to work in the Contamination Reduction Zone or the Exclusion Zone shall complete training conforming to the requirements of 29 CFR 1910.120(e). Field personnel shall complete radiation safety training in compliance with 32 IAC 400. Training will be conducted by a qualified safety specialist and/or a qualified senior health physics technician, at a minimum. The Project Training Plan is included in Attachment 7 to the Work Plan.

DOCUMENTATION AND RECORDS
ELEMENT A9

A. Documents and Records Generated

The following types of data will be generated during the project:

- Surface gamma survey records
- Soil sampling records
- Soil sample field laboratory data
- Fixed laboratory soil analyses data (USEPA contract and STS subcontract laboratories)
- Air quality sampling records
- Air quality analytical data

Surface Gamma Survey Records - These records will be kept on the attached forms (Figure A-9.1). A copy will be maintained in the field office and the original filed in the STS Vernon Hills, Illinois office.

Survey equipment calibration records (daily equipment check records) will be maintained in the field office files.

Soil Sampling Records - These records will be documented in three places. A bound field log book will be maintained by each person conducting field sampling. The pages will be sequentially numbered. Records will include the sampler's name, date, sample number, sample location including site grid and depth, gamma readings, climate and any unusual conditions. The soil sampling records will include a chain of custody (Figure A-9.2). Each sample container will be uniquely identified on the chain of custody. The soil sampling records include the individual sample containers. Each container will have the unique sample number, date, sampler's name or initials, sample time, and project name (GMO) on the sample label.

Soil Sample Field Laboratory Data - These data will be provided in two forms. The initial NUTRANL data set will consist of one set per sample and will include the radionuclide concentrations and error limits for uranium 238, thorium 232, radium 226, and potassium 40; the sample number; date and time sampled; laboratory number (sequential); identify the analyst; and analytic method (NUTRANL).

The second field laboratory data form will be a consolidated spreadsheet with all analysis in sequence by laboratory number. This table will include the sample number, data and time sampled, radionuclide concentrations and error limits for the four NUTRANL analytes, and a line totaling the thorium and radium concentrations. The field laboratory will also maintain a copy of the chain of custody for those samples received and analyzed.

Fixed Laboratory Soil Analyses Data - Records for the fixed laboratories, either the USEPA contract laboratory at Argonne or the STS subcontract laboratories, Severn Trent and/or RSSI, will include chain of custody copies, sample receipt and tracking forms, preparation and analysis logbooks, raw data forms, tabulated data summaries, calibration records, and standards, QC sample results, and any corrective action reports.

Air Quality Sampling Records - These records will include duration of sampling including precise start and stop times, date, location on the site parameter, flow rate, sampling equipment, sampler's initials, climate, and any unusual conditions of the sampled interval or vicinity. For PAM samples, the personnel will be identified and the location(s) worked, in addition to start/stop times, data, flow rate, equipment, climate and any unusual conditions.

Air Quality Sample Results - Data will include a unique sequential laboratory number, the chain of custody, sample identifier (either location or personnel), time and date, one day alpha count and a 4-day alpha count.

B. Data Reporting Package Format and Documentation Control

Data will be recorded in field logbooks according to the procedures in the Field Logbook SOP, 215. As noted in SOP-215, logs for each day will contain, at a minimum,

- Personnel on site (including contractors, visitors and regulators, as applicable)
- Weather
- Equipment used and calibration
- Sketch of applicable work area
- Work summary.

The Project QA Supervisor will perform audits of the field notebooks periodically during the project. The Project Manager or her designee will also review the logbooks prior to submitting monthly reports to EPA. These management audits and QA reports will be submitted to EPA at the end of the Project, as outlined in C1. The Project Manager is responsible for assuring adherence to data quality objectives concerning data reporting and data management.

All waste characterization laboratory analysis performed by STL will follow STL's Data Review and Verification SOP (STL-QA-0011). In addition, data reporting requirements for specific analyses are found in the following SOPs:

- Extraction and Cleanup of Organic Compounds from Waters and Soils, CORP-OP-0001STL
- Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure, CORP-OP-0002STL
- Gas Chromatographic Analysis Based on Method 8000B, 8021B, 8081A, 8082 and 8151A, SW-846, CORP-GC-0001STL
- GC/MS Analysis Based on Methods 8270C and 625, CORP-MS-0001STL
- Determination of Volatile Organics by GC/MS Based on Method 8260B, 624 and 524.2, CORP-MS-0002STL
- Acid Digestion of Soils, SW846 Method 3050B, CORP-IP-0002STL
- Reactive Cyanide, STL-IP-0001
- Reactive Sulfide, STL-IP-0002

- IDL/MDL Determination, STL-QA-0016
- Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy (Method 3010A), STL-IP-0013
- Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analyses, SW-846 Method 6010B and EPA Method 200.7, CORP-MT-0001STL
- Preparation and Analysis of Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW846 7470A and MCAWW245.1, CORP-MR-0005STL
- Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption Spectroscopy, SW846 7471A and MCAWW 245.5, CORP-MT-0007STL
- Cyanide Analysis by the Technicon Traacs 800 Autoanalyzer, STL-WC-0002
- Analysis of pH in Water, STL-WC-0011
- Analysis of Sulfide in Water, STL-WC-0012
- Analysis of pH in Soil, STL-WC-0021
- Flash Point by Pensky-Martens Closed Cup Tester, STL-WC-0026
- Paint Filter Liquids Test, STL-WC-0031
- Preparation of Samples for Gamma Spectroscopy, STL-RC-0025
- Daily Operations of a Germanium Spectroscopy System, STL-RD-0101

C. Data Reporting Package Archiving and Retrieval

STS will store all project records at its Vernon Hills office until directed by EPA to dispose of the records. TRS and the EPA will have access to the data. Any other access will be allowed only after clearance from both TRS and the EPA.

SAMPLING PROCESS DESIGN
ELEMENT B1

The sampling system has been previously described. The project schedule is presented in Element A6, and the sampling design rationale is presented in Element A7.

SAMPLING METHODS REQUIREMENTS
ELEMENT B2

The details of the field sampling procedures for the radiological samples are described in FSP.

In addition to the radiological soil samples, soil sampling will include the following parameters for the Waste Characterization Samples.

Ignitability	Flash Point
Corrosivity	pH
Reactivity	unstable, reacts violently with water, is sufficiently cyanide or sulfide bearing the produce toxic gas, or is capable of detonation.
Toxicity	TCLP analysis for regulated contaminants

Groundwater sampling will consist of the following parameters for the groundwater discharge samples, for discharge to the Chicago city sewers.

Waste or Chemical	Concentration (mg/L)
Cadmium	0.11
Chromium (total)	2.77
Copper	2.07
Cyanide (total)	1.20
Fats, Oils and Greases (FOG) (total)	250.0
Iron	250.0
Lead	0.5
Mercury	0.0005
Nickel	3.98
Zinc	2.61
Dichloromethane	0.294
Chloroform	0.309
1,1,1-Trichloroethane	0.193
Trichloroethylene	0.242
Benzene	0.278
Tetrachloroethene	0.225
Toluene	0.247
Ethylbenzene	0.329
Volatile Organic Compounds (total)*	0.567
Total Toxic Organics**	2.13

pH Range - Not lower than 5.0 or greater than 10.0

Temperatures of liquids or vapors at point of entrance to the sewerage system shall not exceed 150°F.

* Total Volatile Organic Compounds shall be the arithmetic sum of the concentrations of:

dichloromethane
chloroform
1,1,1-trichloroethane
trichloroethylene
benzene
tetrachloroethene
toluene
ethylbenzene

acrolein
acrylonitrile
1,3-butadiene
carbon tetrachloride
chlorobenzene
dichloroethane
dichlorobenzene
1-ethyl 2-methylbenzene
napthalene
styrene
1,3,5-trimethylbenzene
vinyl chloride
xylenes
1,4-dioxane
ethylene dibromide
methyl ethyl ketone

** Total Toxic Organics shall be the arithmetic sum of the concentrations of those pollutants found under Title 40 Part 413.02(i) of the Code of Federal Regulations.

Field sampling procedures for these non-radiological samples are included in the FSP.

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

ELEMENT B3

It is the USEPA and Region 5 policy to follow the USEPA Region 5 sample custody, or chain-of-custody protocols as described in "NEIC Policies and Procedures," EPA-330/9-78DD1-R, revised June 1985. This custody is divided into three parts: Sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A. Field Activity and Sampling Documentation

Field Logbooks will be used to document all sampling activities. Chain of Custody forms shall be completed for all samples (air, soil, and waters). The following information shall be included in the field logbook regarding samples and may be cross referenced with the Chain of Custody Form:

Soil and Water:

- Initial of Technician collecting the sample
- Time and date of sample collection
- Location where sample obtained using appropriated sample grid notations
- Depth where soil sample was obtained

- Count rate (cpm) at the location where sample was obtained
- Unique sample number
- Additional applicable comments pertaining to description of sample matrix, weather, or other factors that may affect sample analysis

Air:

- Initial of Technician collecting the sample
- Time and date of sample collection
- Start and Stop time of air sampler (used to calculate volume)
- Starting and ending flow rate of air sampler
- Location or air sampling station
- Unique sample number

B. Sample Labeling

All samples shall be labeled with the above information and placed into a plastic bag for transfer to the field laboratory. Samples are typically batched in groups depending on their purpose or location (e.g. QC, blanks, close-out, screening).

The technician shall ensure that the information on the sample container is also transferred to the Chicago of Custody Form (See Attachment 1). Prior to labeling the containers, the technician shall ensure that the exterior of the sample container is free from loose soils and/or radioactive contamination. All SOPs still apply for samples leaving an Exclusion Zone. To ensure that all information is retained and verifiable, all applicable information shall also be recorded in the field logbook. Once the sample is transferred to the Field Laboratory it shall be assigned a unique sample number in sequential order.

All samples shall be labeled using permanent ink. No whiteout or erasures are allowed. Any entry that is to be deleted will use a single crossout that is signed and dated.

C. Transfer of Samples

Samples shall be collected and transferred to the field laboratory only by trained and authorized Health Physics personnel. Proper Chain of custody shall be demonstrated by documenting that the sample is always in the possession of an authorized person and under custody. Custody is considered to be in someone's direct possession and/or view, or secured in a locked are under the person's control. Each sample custodian shall sign off on the Chain of Custody form (signature, time and date) for each transfer.

D. Laboratory Custody Procedures

When the samples are received in the laboratory, proper Chain of Custody shall be maintained. Samples shall be logged and assigned a laboratory sample number as soon as they are received. The laboratory technician shall sign the Chain of Custody form in the presence of the Transferor. From this point on the samples shall be considered to be in the custody of the field laboratory supervisor. The laboratory sample number shall be recorded on both the Chain of Custody Form and on the sample container label. This sample number will be assigned in a sequential format that allows each sample to be identified in a unique fashion.

A duplicate copy of the Chain of Custody form shall be placed into a binder when received. The original Chain of Custody form shall stay with the samples until they are placed in the final evidence file.

After all required analyses are performed the samples shall be held in a locked storage with limited access. All samples and analyses data shall be maintained until the appropriate regulatory agency approves disposal. Data from analysis shall be maintained in both a hard copy file as well as a backed up computer format.

E. Outside Laboratory Custody Procedures

In the event that samples need to be transferred from the Field Laboratory to another party, they shall be packaged in accordance with Department of Transportation regulations. Sample coolers shall have all necessary packing material to ensure that no leakage occurs. Un addition, a custody seal shall be placed on the cooler opening to identify unauthorized opening or tampering. Sample containers being shipped to outside parties will also be affixed with seals to identify tampering. Samples not being shipped to outside parties will not need to be sealed, as they are still under direct custody. Air bills used by the shipping company along with a duplicate copy of the Chain of Custody form shall be placed on file as documentation of custody.

F. Final Evidence Files

Upon project completion the following documents will be placed into the final evidence file:

- Chain of Custody forms
- Data from sample analysis
- Any applicable air bills

- Detailed description of final sample disposition. Samples shall be maintained until approval is received to dispose of them or return them to the waste generator
- Field logbooks from all applicable personnel

The final evidence file shall be held at the following address in a secure location:

Stan A. Huber Consultants, Inc.
200 North Cedar Road
New Lenox, Illinois 60451

The file custodian shall be Glenn A. Huber

As required by Section V.5 of the UAO, Kerr-McGee, TRS and all their contractors and agents will preserve all documentation for a minimum of six years following completion of the removal action. The content of the evidence file will include all relevant records, reports, correspondence, logs, field logbooks, laboratory sample preparation and analysis logbooks, data packages, pictures, subcontractor's reports, chain-of-custody records/forms, data review reports, etc. The evidence file will be in the custody of the TRS's Project Manager, and kept in a secured area.

ANALYTICAL METHODS REQUIREMENTS
ELEMENT B4

A field laboratory will be used to analyze samples onsite. The Health Physics subcontractor, Stan A. Huber Consultants, Inc., will manage this laboratory. Off-site laboratory services will be provided by Severn Trent Laboratories (STL) of St. Louis; Missouri, RSSI of Morton Grove, Illinois; and Grace Laboratories of Chicago, Illinois. STL will perform waste characterization analyses, RSSI will serve in a back up capacity to STL, and Grace Labs will perform the potential groundwater analysis. Argonne National Laboratory will provide laboratory subcontract services to USEPA for radiological analysis of samples from this project.

Radium analysis (Ra-226 and Ra-228) will be conducted on soil samples. Analysis will be through gamma spectroscopy at fixed laboratory facilities (Severn Trent Laboratory and Argonne National Laboratory) and through NUTRANL at the field laboratory.

Severn Trent Laboratory
13715 Rider Trail North
Earth City, Missouri 63045-1205

Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439-4836

Field Laboratory
341 East Ohio Street
Chicago, Illinois 60611

The following table summarizes the matrices, parameters and methods used for the various analyses. Reference SOPs for the onsite laboratory are contained in Appendix B. Due to the length of the SOPs from STL, one complete copy has been submitted under separate cover to USEPA and is accessible on CD-ROM for convenience. Further details about laboratory responsibilities are contained in Element A4.D of this QAPP.

Table 8. Laboratory Parameters and Methods by Matrixes

Parameter	Matrix	Method	Responsible Lab
NUTRANL	Solid	See SOPs, Appendix B	Field laboratory
Gamma spectroscopy	Solid	HASL AM-02 MOD	STL
Volatiles	Solid	SW846 8260B	STL
Semi-Volatiles	Solid	SW846 8270C	STL
Pesticides (Organochlorine)	Solid	SW846 8081A	STL
Herbicides (Organochlorine)	Solid	SW846 8151A	STL
RCRA Metals	Solid	SW846 6010B	STL
Corrosivity (pH)	Solid	SW846 9045A	STL
Paint Filter	Solid	SW846 9095, free liquids	STL
Reactive Sulfide	Solid	SW 7.3.4	STL
Reactive Cyanide	Solid	SW 7.3.3	STL
Ignitability (Flashpoint)	Solid	SW846 1010, closed cup	STL
Cadmium	Solid	SW846 6010B/7000	Grace
Chromium (total)	Solid	SW846 6010B/7000	Grace
Copper	Solid	SW846 6010B/7000	Grace
Cyanide (total)	Solid	SW846 335.3 modified for Lachat	Grace
Fats, Oils and Greases (FOG) (Total)	Solid	SW846 1664 with Hexane extraction	Grace
Iron	Solid	SW846 6010B/7000	Grace

Lead	Solid	SW846 6010B/7000	Grace
Mercury	Solid	SW846 6010B/7000	Grace
Nickel	Solid	SW846 6010B/7000	Grace
Zinc	Solid	SW846 6010B/7000	Grace
Dichloromethane	Solid	SW846 8260B	Grace
Chloroform	Solid	SW846 8260B	Grace
1,1,1-Trichloroethane	Solid	SW846 8260B	Grace
Trichloroethylene	Solid	SW846 8260B	Grace
Benzene	Solid	SW846 8260B	Grace
Tetrachloroethene	Solid	SW846 8260B	Grace
Toluene	Solid	SW846 8260B	Grace
Ethylbenzene	Solid	SW846 8260B	Grace
Volatile Organic Compounds (total)	Solid	SW846 8260B	Grace

QUALITY CONTROL REQUIREMENTS

ELEMENT B5

A. Field Sampling Quality Control

Assessment of field sampling precision for the radiological verification sampling will be made through collection of replicate subsamples from the verification sample area. Six subsamples will be obtained by splitting one sample in the field. Each subsample will be analyzed separately in the field laboratory. The subsamples will be composited to develop a single sample for analysis by USEPA's contract laboratory at Argonne National Laboratory (Argonne).

Satisfactory precision will be met if the mean of the six subsamples is within 50% (relative percent difference (RPD)) of the result of the Argonne analytical result. Counting statistics for low activity samples will provide for RPD to increase to 100% for samples where all analysis are below the clean-up criteria of 7.1 pCi/g total radium.

QC procedures for field measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Gamma radiological survey QC is described in Appendix B.

Two types of QA will be used by the laboratory to ensure the production of analytical data of known and documented usable quality. These types are QA program and QC checks.

B. Analytical Quality Control Checks

The Severn Trent laboratory has a written QA/QC program which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory.

The stated objectives of the laboratory QA/QC program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures
- Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated
- Monitor the performance of the laboratory by a systematic inspection program and provide for a corrective action as necessary
- Collaborate with other laboratories in establishing quality levels, as appropriate
- Ensure that all data are properly recorded and archived

All laboratory procedures are documented in writing as either SOPs or Method Procedures. Internal QC procedures for analytical services will be conducted in accordance with standard operating procedures and the individual method requirements.

The specifications include the types of QC checks required (reference samples, controls, blanks, interlaboratory comparison), the frequency of each check, and the quality control acceptance criteria for these checks.

The laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be re-analyzed by the laboratory, if sufficient sample volume is available. It is expected that a sufficient volume of soil will be collected for re-analyses.

INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE REQUIREMENTS

ELEMENT B6

As part of the FSP and the Health and Safety Plan, routine maintenance procedures for equipments used in the field in defined by both action and frequency. Both of these documents are included in the Remediation Work Plan.

As part of the QA/QC program, a routine preventative maintenance program is conducted by the laboratory to minimize instrument failure and other system malfunctions. The laboratory performs routine scheduled maintenance, and repairs or coordinates with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided by factory representatives. The laboratory SOPs are included in Appendix B.

INSTRUMENT CALIBRATION AND FREQUENCY

ELEMENT B7

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the sampling will be examined to certify that it is in good operating condition. This includes ensuring that all maintenance requirements are being observed. Notes from previous sampling trips will be reviewed so that any prior equipment problem is not overlooked, and all necessary repairs to equipment have been completed.

Calibration of instruments is governed by the specific SOP for the applicable analysis method, and such procedures take precedence over the following general discussion. All survey instruments used during the excavation and restoration activities shall be calibrated semiannually or when maintenance is required that could affect the calibration. Counters used for air samples shall be checked before use or daily, using calibrated reference sources. Vendor calibration procedures shall be in accordance with the American National Standards Institute (ANSI) N323-1978 and calibration shall be traceable to the National Institute of Standards and Technology (NIST).

Alpha counters use an ionizable gas to detect alpha radiation. The instrument measures alpha and beta/gamma present on filter paper. This instrument is checked daily using a reference source. The calibration procedure is described in the attached SOPs. Air pumps used to collect air monitoring samples will be calibrated daily.

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Calibration and record management procedures are presented in the applicable REF SOPs.

INSPECTION/ACCEPTANCE OF REQUIREMENTS FOR SUPPLIES AND CONSUMABLES
ELEMENT B8

Details of the procedures that will be used to ensure supply cleanliness and reagent purity are described in the FSP (Appendix 9 of the Removal Action Work Plan) and the attached SOPs in Appendix B. The inspection/acceptance requirements for consumables and supplies that will be used in the field and laboratory are detailed in SOP-LLI1345, Surveys for Contamination and Release of Equipment for Unrestricted Use and in the documented SOPs and Method Procedures for the laboratories.

DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)
ELEMENT B9

The following reports of previous environmental investigations were provided by TRS for the preparation of the Remediation Work Plan.

- Letter dated August 22, 1990 from OHM Corporation to GMO Limited Partnership
- Environmental Site Assessment dated August 28, 1990 prepared by Professional Service Industries, Inc.

- Visual Site Inspection dated December 30, 1993 prepared by USEPA, Region 5, with attached Preliminary Assessment/Visual Site Inspection Report dated December 16, 1993 prepared by PRC Environmental Management, Inc.
- Preliminary Environmental Review dated March 8, 2000, prepared by GaiaTech, Inc.
- A Phase II Soil and Groundwater Investigation Report Time-Life Property, Grand Avenue and McClurg Court, Chicago, Illinois, dated May 11, 2000, prepared by GaiaTech, Inc.
- Summary of Radiological Survey Time-Life Property, Chicago, Illinois, dated May 2000, prepared by B. Koh & Associates, Inc.
- Scanner Van Survey of the Chicago Illinois Streeterville area dated July 12, 2000 prepared by USEPA Radiation and Indoor Environments National Laboratory.

The delineation of the radiologically impacted materials was initiated through an investigation completed by B. Koh and Associates, Inc. as documented in their May 2000 report listed above. The delineation will be further developed in the initial stages of pavement removal and ground survey, as described in Section 4 of the Removal Work Plan.

INSTRUCTIONS FOR DATA MANAGEMENT

ELEMENT B10

A. Data Recording

Two types of data will be collected: Field laboratory analysis using NUTRANL software and gamma spec detectors; and field survey gamma radiation data.

NUTRANL analysis reports are printed directly, one for each sample. A copy is attached.

The detector is calibrated daily. Calibration records are maintained at the field laboratory. Calibration forms are attached.

The Data Quality/Records Manager will review the results. Comparison with field survey data will provide a means of identifying errors. Calibration data will be reviewed weekly.

The field gamma surveys consist of manually collected data as the excavation proceeds. A sample data form is attached. Validation occurs as the soil is resurveyed at 18-inch intervals during excavation. When contamination is detected an exclusion zone is established and closure verification procedures are required.

Closure verification consists of a pre-verification survey when all identified impacted soil is removed. No documents are generated for that survey. A sample is collected, transmitted under chain-of-custody (copy attached) to the field laboratory, and analyzed by NUTRANL. Upon demonstration of the pre-verification sample passing the cleanup criteria, USEPA mobilizes staff to the site, conducts a walkover survey with no written documentation, and collects a set of six sub-samples for every 100 m^2 area to be verified as clean. Those samples are transferred under chain-of-custody to the field laboratory and analyzed by NUTRANL. Upon receipt of results showing the area meets clean closure standards, the results and a Notification of Successful Verification Survey Form is transmitted to USEPA On-Scene Coordinator for signing. A copy of a notification form is attached.

The verification samples are subsequently forwarded under chain-of-custody to USEPA's contract laboratory, Argonne National Laboratory. Reports of that analysis are not provided to be included in the documents generated for this investigation.

B. Data Validation

Data validation of the NUTRANL analysis is provided by comparison of six replicate analysis of subsamples for each verification analysis. Additionally, those data of the samples are provided to USEPA, with the samples reanalyzed at Argonne. The six replicate analysis and the field data from the closure verification surveys are compared to identify anomalous data.

C. Data Transformation/Data Reduction

A transformation is to be used for converting the measured radionuclides activity to the cleanup standard activity. NUTRANL will measure the following:

Uranium 238	(U-238)
Thorium 232	(Th-232)
Radium 226	(Ra-226)
Potassium 40	(K-40)

The cleanup criterion is 7.1 picocuries per gram (pCi/g) total radium, Ra-226 plus Ra-228. Radium 228 will be measured using thorium 232 as a surrogate.

The total radium activity will be calculated as follows:

Ra-226 + Th-232 = Total Radium

All data transformation calculations will be checked by the Data Quality/Records Manager.

D. Data Transmittal/Transfer

Two principal data transmittals will occur during the project: transfer of data from the field laboratory to the project team; and from the project team to USEPA.

Transfer of field laboratory data to the project team will include the following:

1. Field laboratory personnel will make a xerographic copy of the NUTRANL report and file sequentially by sample number.
2. A copy will be transmitted by facsimile to STS's offices in Vernon Hills, Illinois, to the attention of the Project Manager, Julie Apolinario.
3. The original will be hand delivered to the Data Quality/Records Manager at the project field office.

The field laboratory will also generate data regarding air quality monitoring. Those data will be provided directly from the laboratory in the same fashion as the NUTRANL data.

1. A xerographic copy will be made and filed sequentially by sample number.
2. A copy will be transmitted by facsimile to the STS Vernon Hills, Illinois, office to the attention of the Project Manager, Julie Apolinario.
3. The original will be hand delivered to the Data Quality/Records Manager at the field office.

These air quality data will be transmitted by the Project Manager to USEPA on a weekly basis with the weekly status report. That report and accompanying data will be transmitted by facsimile.

The verification analytical data for the six subsamples from each area to be closed will be transmitted by facsimile to USEPA with the Notification of Successful Verification forms upon receipt of complying data. The signed forms are returned by facsimile from USEPA and copies are kept at the field office and at the STS Vernon Hills, Illinois office.

E. Data Analysis/Data Assessment

The data analysis and data assessment will consist of a pass-fail comparison to the cleanup criteria of 7.1 pCi/g total radium. There is no modeling involved. There are no secondary data manipulations involved. All computer data storage will be commercially available spreadsheets (Microsoft Excel) with no manipulation or calculation of the data other than as described above under Data Transformation.

F. Data Tracking

Data will be tracked by geographic grid designation. As a location is identified as thorium-impacted, the following steps will track the data and clean closure.

1. The impacted zone will be marked by rad rope (braided magenta and yellow) as an exclusion zone.
2. The coordinates of the exclusion zone will be marked on a daily report form (copy attached).
3. The exclusion zone(s) will be plotted on a site map daily. This site map will be maintained by the Field Team Leader and Data Quality/Records Manager. An updated copy (xerographic copy) will be couriered to the STS Vernon Hills, Illinois office weekly.
4. The Data Quality/Records Manager, or in his/her absence, the Field Team Leader, will confirm data verification analysis have been received, and Notification of Successful Verification form sent to and returned from USEPA before exclusion zone(s) are backfilled.
5. The field map of exclusion zone(s) will be marked in color to designate identified exclusion zone(s) (perimeter marked in red), and a verified clean exclusion zone(s) (interior shaded in green). The updated map will be copied (xerographic) and provided by courier weekly to the STS Vernon Hills, Illinois office.
6. The Data Quality/Records Manager will be the person responsible for data tracking and to confirm all appropriate data is received and stored at the field office and the STS Vernon Hills, Illinois office.

G. Data Storage/Retrieval/Security

Data will be stored in three locations in addition to whatever storage of transmitted data is provided by USEPA. At the project site, data will be initially stored by the field laboratory subcontractor. That storage will be both an electronic archive on the computer hard drive, and in a hard copy printout filed sequentially by sample number. That location will be in a basement office in the Time-Life building adjacent to the project site and will be maintained for the duration of the fieldwork. Upon demobilization, that data will be transferred to the contractor's office in New Lenox, Illinois, and retained for one year.

The second location is in the STS field office at the project site. That data set will be maintained by the Data Quality/Records Manager. That location will be either in a construction-type trailer or a basement office in the Time-Life building. The data will be maintained at that location until completion of the fieldwork and notification from USEPA that all impacted soil has been removed from the site. Upon demobilization, the data files will be transferred to the STS Vernon Hills, Illinois office to be incorporated in the project files and archived for permanent storage.

The third location will be at the STS Vernon Hills, Illinois office. Copies transmitted to the Project Manager will be stored at this location until the field files are received following completion of the fieldwork. At that time, redundant files will be discarded and the permanent files placed in the STS project archives.

STS provides for off-site secure storage of electronic copies of project files. These will include data received by facsimile or email, and electronic tables or text generated for the project documentation. STS also provides for off-site secure storage of hard copies of project files following copying on microfilm after a period of on-site storage of approximately seven years.

The field laboratory space will be in secure, locked offices in the Time-Life building. The daily transmittal of data and weekly updates of site maps to the STS Vernon Hills, Illinois office provides for security with regards to the field office files.

ASSESSMENT AND RESPONSE ACTIONS

ELEMENT C1

Assessment

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. The audits of field and laboratory activities may include two separate, independent parts: internal and external audits. This QAPP provides procedures for those audits that will be conducted by TRS and its contractors.

Two types of QA will be used by the laboratory to ensure the production of analytical data of known and documented usable quality. These types are QA program and QC checks.

The stated objectives of the laboratory QA/QC program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures;
- Ensure that all analytical procedures are conducted according to sound scientific principles and have been validated;
- Monitor the performance of the laboratory by a systematic inspection program and provide for a corrective action as necessary;
- Collaborate with other laboratories in establishing quality levels, as appropriate; and
- Ensure that all data are properly recorded and archived.

All laboratory procedures are documented in writing as either SOPs or Method Procedures. Internal QC procedures for analytical services will be conducted in accordance with standard operating procedures and the individual method requirements.

The specifications include the types of QC checks required (reference samples, controls, blanks, interlaboratory comparison), the frequency of each check, and the quality control acceptance criteria for these checks.

The laboratory will document in each data package provided that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be re-analyzed by the laboratory, if sufficient sample volume is available. It is expected that a sufficient volume of soil will be collected for re-analyses.

External performance and system audits of the laboratories selected for the project for approval/disapproval may be conducted by personnel from the USEPA Region 5 Air and Radiation Division with assistance from USEPA's National Air and Radiation Environmental Laboratory and/or USEPA's Environmental Monitoring Systems Laboratory. USEPA Region 5 Superfund FSS has the discretion to audit the waste characterization laboratory and these audits may or may not be announced.

Field Audits

Internal audits of field activities (sampling and measurements) will be conducted by the TRS Project Quality Assurance Supervisor. The audits will include, but not be limited to, examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc.

A field audit will take place to determine that personnel are executing required project activities and to verify that all established procedures are being followed. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the excavation and restoration activities. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

External audits may be conducted by personnel from the USEPA Region 5 Air and Radiation Division with assistance from USEPA's National Air and Radiation Environmental Laboratory and/or USEPA's Environmental Monitoring Systems Laboratory.

Laboratory Audits

The internal performance and system audits of the laboratory(ies) will be conducted by a qualified STS auditor. The system audits, which will be done annually, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedure, sample preparation and analysis, instrument operating records, etc.

External performance and system audits of the laboratories selected for the project for approval/disapproval may be conducted by personnel from the USEPA Region 5 Air and Radiation

Division with assistance from USEPA's National Air and Radiation Environmental Laboratory and/or USEPA's Environmental Monitoring Systems Laboratory.

Reports

The auditor will prepare a report describing the audit findings. The auditor will review the report with the laboratory and the Project Manager, and provide a copy of the audit to the person responsible for that activity. Copies also will be submitted to the Project Manager and placed in the project quality assurance file.

The responsible party will respond to the audit findings, describing the cause of the finding, the remedy to be implemented to cure the deficiency, the actions to be taken to prevent the reoccurrence of the defect, and the schedule to address these actions.

When the indicated corrective actions have been completed, the responsible party will notify the auditor. When all findings have been addressed, the auditor will prepare a closing report documenting that the audit findings have been resolved, and that the audit has been closed. This report will be submitted to the Project Manager and placed in the project quality assurance file.

Response Actions

STS's QA system employs corrective and preventive action to correct and eliminate root causes of problems which are systemic and/or repetitive, or which could occur at a future time. When solutions require changes to the quality system and its documentation, those changes are recorded and captured within the document control system.

Corrective Action

Corrective action is necessary to remedy nonconformities that occur in the QA System. Nonconformities can be reported by the customer, by any supplier or by a contractor. Corrective action includes:

- Identification of observed nonconformances in supplied product, services, operations, or output product;
- Investigation of the discrepancy;
- Determination of the cause;

- Initiation of actions to correct the nonconformance to a degree appropriate to the magnitude of problems and commensurate with the risks encountered;
- Evaluation of the effectiveness of the corrective action in preventing recurrence; and
- Changing the system and system documentation when necessary.

Responsibility for corrective action is determined organizationally by the area affected. The Project Manager or designee approves all corrective action and periodically reviews corrective action to verify effectiveness. Corrective action involving a supplier or contractor requires that supplier or contractor to provide the following information:

- Description of factors contributing to the deficiency
- Description of the remedy to correct the nonconformance

Conditions adverse to quality, safety, reliability, or performance are documented and reported to appropriate management for corrective action.

Preventive Action

Where corrective action is necessary to eliminate a nonconformance or correct a deficiency within the quality assurance system, preventive action is taken to discover and eliminate potential nonconformance. Preventive action includes:

- Periodically reviewing work operations, audit results, quality records, service reports, and customer complaints to detect and eliminate potential causes of nonconformities
- Discovery and evaluation of alternative solutions to prevent nonconformance to a level corresponding to the risks encountered
- Implementation of an appropriate solution alternative
- Evaluation of the effectiveness of the preventive action to prevent recurrence
- Changing the system and system documentation when necessary
- Assuring that Management reviews all preventive actions
- Establishing procedures to assure that the preventive action process occurs continually

Responsibility for preventive action is the same as for corrective action discussed above.

Sample Collection/Field Measurements

All project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document to the Project Manager or designee. The Project Manager will be responsible for assessing the suspected problems. The assessment will be based upon the potential for the situation to impact the quality of the product. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the Field Team Leader.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- Evaluating all reported nonconformances
- Controlling additional work on nonconforming items
- Determining disposition or action to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring nonconformance reports are included in the final site documentation in project files

If appropriate, the Project Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

When it becomes necessary to modify a program, the responsible person notifies the Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the Project Manager. The change in the program will be documented on the field change request that will be signed by the initiators and the Field Team Leader. The field change request for each document will be numbered serially as required. The field change request shall be attached to the file copy of the affected document. The Project Manager must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The Project Manager for the Site is responsible for controlling, tracking, and implementation of the identified changes. Reports on all changes will be prepared by the Project Manager and distributed to all affected parties that include the USEPA OSC. The USEPA OSC will be notified whenever program changes in the field are made.

Laboratory Corrective Action

Implementation of corrective actions for the laboratory will be the responsibility of the laboratory personnel.

REPORTS TO MANAGEMENT

ELEMENT C2

In addition to the audit reports submitted to the Project Manager in accordance with QAPP Element C1, a report summarizing QA activities and issues will be included with the final Excavation Closure Report. This report will be an attachment to the final Excavation Closure Report and will contain QA sections that summarize data quality information collected during the project.

The QA activities report in the final Excavation Closure Report will be a written report produced by STS and will contain the following information:

- Changes in QAPP
- Summary of QA/QC programs, training and accomplishments
- Results of technical systems and performance evaluation audits
- Significant QA/QC problems, recommended solutions, and results of corrective actions
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and method detection limit
- Indication of whether the QA objectives were met
- Limitations on use of the measurement data

DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS

ELEMENT D1

Data review, validation and verification requirements are presented in Elements B1, B2, B3, B4, B5 and B7. The Project QA Supervisor is responsible for validation of the laboratory data, as outlined in the Project Management Section. No deviations from the procedures presented in these Elements is anticipated.

DATA REDUCTION, VALIDATION, AND REPORTING PROCEDURE

ELEMENT D2

PURPOSE

The purpose of this procedure is to present protocol for data reduction, validation, and reporting. The procedure includes data listing and tables, validation for field and laboratory data, calculations, and statistical analyses.

SCOPE

This procedure applies to field and laboratory data generated at the Site.

REFERENCES

STS Consultants, Ltd. Quality Assurance Manual

EQUIPMENT AND MATERIALS

Chain-of-Custody Sheet

INSTRUCTIONS

Data Reduction Schemes

Data reduction schemes will be used to structure, analyze, simplify, and present collected data. These procedures assure a systematic approach to data reduction and analysis. Procedures to be used to manage these data are:

- Listing of data;
- Summary statistical tables; and
- Data simplification.

Listing Data

Data, as originally recorded in the field at the time of sampling or as reported and verified by the analytical or testing laboratory, are to be compiled in sampling reports for each sampling event or period. These data are to include the information pertaining to QC (e.g., field blanks, split samples). Laboratory reports are to indicate that the laboratory has performed and reported standard control procedures (e.g., duplicates, recovery analyses) and should include the data that were used to determine the method detection limit.

Data will be listed in an orderly and logical format. A computerized database system may be used. Accuracy of data lists and computerized databases, if used, are to be verified by treating the tabulations and entries as calculations.

Summary of Statistical Tables

Where appropriate for reporting purposes, data may be summarized and presented in tabular form. Appropriate summary statistics would be calculated and presented in a summary table. These statistics may include:

- total number of values
- mean
- median
- standard deviation
- minimum value
- maximum value
- minimum detectable activity concentration

Other statistics may be included in data summaries where appropriate.

The listing of data will be combined with the statistical summary. Sample sizes, ranges, and minimum and maximum values allow evaluation of spatial and temporal changes in parameter values. Statistical summaries will be developed as calculations are subjected to the requirements of the calculation procedures included in this document.

Data Simplification

Data simplification will be used as a tool for data reports. Data simplification is the presentation of data using ranking procedures. Rankings can be performed using mean, median, maximum, or minimum values. Rankings can be developed based on the information that the analyst wishes to convey. This procedure often is complimentary to graphical displays of data.

Validation Criteria

Data will be validated at each step of collection, reduction, and reporting using procedures summarized below.

Laboratory Validation

Laboratory validation of data will follow standard operating procedures specified in the laboratory QA plan. Data that do not meet validation criteria will be identified by the laboratory when the data report is issued.

Laboratory validation of data will consist of monitoring the variations in the accuracy and precision of routine analytical procedures through the use of surrogate recoveries, certified check standards, and instrument blanks. QC sample recoveries must fall within the upper and lower control limits for each control parameter. Instrument blanks are used to determine the method detection limit per NRC regulatory Guide 4.14. Calculations will be checked using the procedures in this document.

Field Data

As specified in this document, standardized data collection procedures, including calibration procedures will be used. Each person assigned to each data collection task is responsible for understanding and employing the standard procedures to be used. Field data collected will be recorded on appropriate data collection forms or a field logbook.

The Quality Assurance Supervisor will review representative data collection forms to confirm that proper data forms are used, that required information is recorded, and that calibrated equipment is used where appropriate.

Receipt of Laboratory Data

Data received from analytical and soil laboratories will be reviewed by the laboratory supervisor(s) for obvious discrepancies. The laboratory generating analytical data for this project will be required to submit results that are supported by sufficient backup and QA/QC data to enable the reviewer to determine conclusively the quality of the data. Validity of laboratory data will be determined based on the precision and accuracy of the objectives presented in this document. The data validation process also will include an assessment of holding-time compliance, laboratory instrument performance, calibration procedures, results of calibration, and results of instrument and method blanks. Upon completion of the review, the laboratory will be responsible for developing a QA/QC report for each analytical data package. All data will be stored and maintained according to the standard procedure of the laboratory QA plan. Where test data have been reduced, the reduction method will be described in the report provided by the laboratory or will reference the applicable section of the laboratory QA plan.

Laboratory data will be reported in the measurement units indicated in the analytical procedures. For tasks for which measurement units have not yet been determined, laboratory data will be reported in the measurement units specified in the appropriate work plan. Issuance of a laboratory report will indicate that requisite calculations specified in the laboratory QA plan have been completed and validated.

Where applicable, outlier treatments and statistical and trend analysis may be applied to the data for validation purposes. Verification criteria for these methods are described in this procedure.

Calculations

Calculations include data manipulations that can be checked and that are made in conjunction with the analysis or interpretation of data, engineering design, cost estimate, or any other related activity. Calculations include: solution of mathematical equations; preparation of input and checking of output of computer models; drawings of cross-sections, isopachs, contour maps; and other geologic, hydrologic, and engineering interpretations. Calculations also include any process or reasoning used to develop a conclusion used or expressed in a report. Calculations will be reviewed according to the applicable procedures in this document.

Database Entries

Upon receipt of data reports from the laboratories, data will be reviewed for obvious discrepancies. After screening, the data will be entered into the appropriate database. After data entry, the entries will be printed and checked against the original data. Errors will be corrected and the corrections verified by checking against the original data.

USABILITY/RECONCILIATION WITH DATA QUALITY OBJECTIVES
ELEMENT D3

Element A7 describes data reconciliation with data quality objectives. Element C1 describes assessment and response actions to be put in place when data do not meet the project quality objectives.

ATTACHMENT 1

PROJECT MANAGEMENT ORGANIZATION CHART

ATTACHMENT 2

CHAIN OF CUSTODY FORM
STAN A. HUBER CONSULTANTS, INC.

ATTACHMENT 3

CHAIN OF CUSTODY FORM
QUANTERRA

ATTACHMENT 4

CHAIN OF CUSTODY FORM
GRACE ANALYTICAL LAB, INC.

ATTACHMENT 5

NUTRANL LABORATORY REPORT

ATTACHMENT 6

NUTRANL DAILY CALIBRATION FORM

ATTACHMENT 7

FIELD GAMMA SURVEY FORM

ATTACHMENT 8

CHAIN OF CUSTODY FORM
STS CONSULTANTS, LTD.

ATTACHMENT 9

NOTIFICATION OF SUCCESSFUL VERIFICATION SURVEY FORM

ATTACHMENT 10

DAILY FIELD REPORT FORM